



Research paper

The Darknet and suicide

Carl-Maria Mörch^{a,b,*}, Louis-Philippe Côté^{a,b}, Laurent Corthésy-Blondin^{a,b},
Léa Plourde-Léveillé^{a,b}, Luc Dargis^{a,b}, Brian L. Mishara^{a,b}

^a Centre for Research and Intervention on Suicide, Ethical Issues and End of Life Practices (CRISE), Université du Québec à Montréal, Canada

^b Psychology Department, Université du Québec à Montréal, Canada



A B S T R A C T

Context: The Internet contains both public content (“Surface Web”), and private content (“Deep Web”) sometimes hosted on exclusive networks (“Darknets”) only accessible using dedicated software such as TOR (The Onion Router). This software makes it almost impossible to identify its users. Information media have reported on suicide-related aspects of Darknets, for example when poisons that can be used to kill oneself are offered for sale (Le Garff et al., 2016) when users discuss ways to kill oneself in anonymous forums (Ferrara, 2016; Franceschi-Bicchieri, 2015) and suicides that follow bullying or “doxing” (online divulgence without consent of intimate personal information) (Bartlett, 2015). Several recent studies have analyzed the nature of suicide content on the Surface Web, but to date, there have been no systematic investigations of suicidal content available on Darknets. **Objectives:** The object was to document the nature and accessibility of suicide-related information available on the TOR Darknet or via the TOR software.

Methods: We replicated the methodology used by Biddle et al. (2008, 2016) in their studies of the Surface Web, using TOR on the Darknet. We identified and chose nine search engines used on the TOR Darknet: TORCH the TOR search engine, Notevil, Ahmia, Candle, Hidden Wiki, Darknet (onion.link), Duckduckgo and Grams. Two research assistants independently coded the first 30 results of searches using the keywords, “suicide” and “suicide methods”.

Results: There were 476 “hits” in the search for “suicide” and “suicide method” using TOR, with fewer sites dedicated to suicide (4%), compared to the Surface Web (23.1%) (Biddle et al., 2016). Over half of the sites proposed by the TOR search engines (252, 52.9%) were outdated, inaccessible or not containing content pertinent to suicide or suicide methods. Several of the TOR search engines provided access to forums (“chat boards”) where suicide was a topic (70, 14.8%). These were usually pro-suicide, are blocked or filtered by most of the Surface Web engines (e.g. Google).

Discussion: Persons concerned with suicide prevention should conduct further investigations of pro-suicide forums that are accessible using TOR and their users, comparing them with the Surface Web. New strategies to prevent suicide may need to be developed for Darknets.

1. Introduction

A Darknet is a part of the Internet that is not accessible by conventional search engines, such as Google. It is a closed (“overlay”) network, available to all internet users who install specific software, such as The Onion Router (TOR), Freenet or I2P. This paper presents a study that describes information on suicide available on the Darknet accessible via the TOR software, its nature and its accessibility to the general public. Before presenting our study, we describe the TOR Darknet in relation to the Surface Web, and studies to date on internet suicide content.

Many recent studies have documented suicide content available on the public part of the internet (Biddle et al., 2012; Thoër, 2013). Most of the studies describe content available on social media (Robinson et al., 2015) or all content found using conventional search engines, such as Google, Bing, Yahoo (Durkee et al., 2011). Until now, there are no studies on the suicide content available on other ‘hidden’ parts of the internet.

The expression “Deep Web” was first used in 1994 to designate that part of the web that was not referenced by conventional search engines and not accessible using traditional methods (Bergman, 2001; Gupta and Bhatia, 2014; He et al., 2007). It contrasts with the public part of the Internet (the “Surface Web”), and was sometimes referred to, in the literature, as the “Invisible Web” (Sherman and Price, 2001) or the “hidden web” (He et al., 2007). The content of the Deep Web is either not indexed or poorly indexed by traditional search engines: the pages are sometimes voluntarily not referenced and there are pages that are proprietary (they can only be accessed by identified people who are authorized for access), as well as having changing dynamically-generated content (in contrast with content where the pages are static and unchanging) (Sherman and Price, 2001). In other words, the Deep Web contains information that could be considered to be sensitive, such as information belonging to corporations, private content, and banking information (Rouse, 2016). Because of the often intentionally hidden nature of the content on the Deep Web, it is difficult to describe and access its content (Chen, 2011; Madhavan et al., 2009; Sherman and

* Corresponding author at: Centre for Research and Intervention on Suicide, Ethical Issues and End of Life Practices (CRISE), Université du Québec à Montréal, C.P. 8888, Succ. Centre-Ville, Montreal, Quebec H3C 3P8 Canada.

E-mail address: morch.carl_maria@courrier.uqam.ca (C.-M. Mörch).

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Price, 2001).

Within the Deep Web and the surface web, there are organized networks called “Darknets”, which are accessible only with dedicated software. The most commonly used are TOR (The Onion Router), then Freenet and I2P. TOR is a free open source software, giving access to a network that consists of over 3000 chains of volunteer-run servers (Biryukov et al., 2013; Masterson, 2015). In 2017, TOR had over 2 million users, including 40,000 in Canada, 90,000 in France and 400,000 in the United States (TOR Project, 2017). TOR, like Freenet and I2P, circumvents any form of censorship by providing relative anonymity to users so that restrictions imposed on search engines by government regulators can be avoided (Thill, 2014). Censorship and identification of users is circumvented by a sophisticated encryption platform that allows users to navigate anonymously on TOR-exclusive sites (or “services”) and regular public websites (Moore and Rid, 2016). For this reason, TOR has a reputation for being used to obtain illegal services and of supporting illegal trafficking in goods, such as arms sales, illicit drugs, exchange of cryptocurrencies, and allowing access to non-referenced sites such as the now closed service : “Silk Road” (Broséius et al., 2016; Mireault et al., 2016).

Bartlett (2015) observed that there is confusion in both publications and the public concerning the distinction between the terms “Darknet”, “Deep Web” and “Dark Web”. These terms are sometimes used interchangeably, although one can make an important distinction between them. The term “Dark Web” usually refers to all activity and content that is illegal, morally questionable or ambiguous, that one finds on the internet (Cohen-Almagor, 2015). The dark web can be considered a “catch-all” term that can be used to describe all internet content, on the surface and on the Deep Web, that is shocking, disturbing or controversial (Bartlett, 2015). The term dark web is often associated with the hidden part of the internet, such as criminal and morally questionable activity obscured from surveillance and regulation (Cohen-Almagor, 2015). Media attention to illegal drug-trafficking using TOR and stories about violent and disturbing content on the Darknet have led to the false belief that many people hold that the Deep Web and the Darknet are one and the same, called the ‘dark web’. However, the Deep Web and the Darknet can be defined by their technical characteristics, whereas the term Dark Web is a normative concept. For clarity, this study will solely focus on the TOR Darknet and will not use the terms “Deep Web” or “Dark Web”.

In summary, “Surface Web”, “Deep Web”, “Darknet” and “Dark Web” are all part of the Internet. These different designations are not always clearly defined and sometimes overlap. However, each concept has its specificities in terms of 1. the extent of retrievability of their content by regular search engines, 2. the presumed proportion of illegal content, 3. the level of censorship. Table 1 describes each of these concepts based on these three characteristics.

The Deep Web differs from the Surface Web particularly in terms of retrievability. It is more difficult to access the Deep Web since it consists for the most part of unindexed, weakly indexed or strictly private content (e.g. emails). It also contains illegal content (e.g. drug-related). The amount of censorship of the Deep Web is also lower because companies and governments exert more effort to censor the “accessible” content of the surface web.

A Darknet is characterized by a low level of retrievability of its

content and a potentially higher level of illegality than the Surface Web. The level of censorship is presumably low, given the nature of the software and the technical challenges for its implementation. The Dark Web also has the highest level of illegal content. This is due to the fact that most of the definitions of Dark Web are morally-based and refer broadly to all the illegal content that can be found on the Internet. Dark Web content can be found on a Darknet, which belongs to a Deep Web or a Surface Web website.

It is worth noting that a website can be simultaneously found on the surface web, the Deep Web, the Darknet and the Dark Web at a given time, and eventually it could be eliminated by censorship, legal procedures or to migrate content from the surface web to the Darknet, the Dark Web or the Deep Web.

It should be noted that this way of delimiting these areas of the internet is conceptual and aims to help the reader better understand this research on the level of accessibility and the nature of the content relating to suicide and suicide methods in the TOR darknet.

From time to time, there have been media reports on suicides which were said to be associated with content on the Darknet, such as suicides by ingesting poisons purchased on cryptomarkets (Le Garff et al., 2016), forums where people encourage others to kill themselves, provide information about suicide methods and suicides following bullying or “doxing” (Ferrara, 2016; Franceschi-Bicchierai, 2015). However, we are not aware of any published systematic study of suicide content on Darknets.

2. Methods

2.1. Procedure

Our research is theoretically related to the interpretative theory (Poupart et al., 1997). This approach assumes that to create a sound methodology, it is important to take into consideration both existing evidence-based theories and interpretations of reality by social actors. This is useful when researchers want to replicate a methodology to a new context - different than the context originally intended. The methodology was designed as a conceptual replication of Biddle et al. (2008; 2016), in the sense of Zwaan et al. (2017). They distinguish between “direct replications” and “conceptual replications.” Direct replication to refer to studies intended to evaluate the ability of a particular method to produce the same results upon repetition and conceptual replication refers to studies designed to test the same theoretical idea using an intentionally different method than previous studies.” (Zwaan et al., 2017, p.13).

This study aims to answer to the same question as (Biddle et al., 2008). But, because of the nature of the TOR Darknet, we could not completely replicate the same design, because of the nature of the content proposed by the search engines used to search TOR Darknet. (Biddle et al., 2008) examined the ten first results of each of the search engines they explored, assuming that users generally do not exceed this limit (Eysenbach & Köhler, 2002; Vandeursen & Vandijk, 2010). This assumption can be justified in part by the fact that only 0.8% of the results offered by the search engines were inactive links (category J), leaving the users plenty of content to consult in the first 10 results of each traditionally search engine. However, over half of the results proposed by the TOR search engines were inactive links (category J), making Biddle et al.’s assumption not applicable to the TOR context. We therefore, we analyzed the first 30 results of the TOR search engines. We assumed that an average user would explore TOR results beyond the first 10 because so many of those results are to inactive sites. Also, the number of keywords used to generate results in the TOR search engines was reduced, under the assumption that an average user would not run multiple search queries if each of them generates too many unavailable results. Therefore, while Biddle et al. (2008, 2016) used 12 key words in their searches, we only focused on the two keywords combinations: “suicide” and “suicide methods”. One of the main reasons was that

Table 1
Synthetic description of the “Surface Web” the “Deep Web”, the “Darknet” and the “Dark Web”.

	Surface web	Deep Web	Darknet(s)	Dark Web
Level of retrievability of its content	++	--	+-	+-
Level of illegal content	+-	+-	+-	++
Level of censorship	+-	+-	--	+-

these two words (suicide and methods) were present in 11 of the 13 search terms used by Biddle et al. (2016, 2012). Also, most other studies of suicide content on the internet used only the terms, “suicide” and “suicide methods”. These methodological adaptations were considered to be necessary to answer the same research question as Biddle and colleagues, while maintaining comparability of the interpretation of the results.

Our conceptual replication of Biddle and colleagues’ methodology used search engines that can locate TOR-related content (on the Darknet and the surface web) or content accessible via the software itself. The most popular TOR-related search engines can be divided into four categories: (a) “TOR-specific”: 6 search engines that can be used to find information that is exclusively on the TOR network : TORCH, “TORCH : the TOR search engine”, Notevil, Ahmia, Candle, Hidden Wiki; (b) “Gateway”: 1 search engine that permits access to TOR services through a surface website (called “Gateway”) that can be used without installing TOR: Onion.link; (c) “Privacy”: 1 search engine embedded by default in the TOR software that searches surface web content privately: Duckduckgo a popular surface web search engine that doesn’t track its users (unlike Google, Bing, Yahoo); (d) “Darkmarket”: 1 search engine specialized in illicit TOR Darknet’s services: Grams.

2.2. Keywords and data collection

We used the terms, “suicide” and “suicide methods” in the present study. We analyzed the 30 first research results for each search engine, because of the large proportion of results identified for which the hyperlink was outdated or did not work. Although we decided to study the first 30 results, not all the search engines identified 30. For example, Ahmia only identified 5 results for the term “suicide” and 12 for “suicide methods”.

2.3. Content analysis

We used the coding framework developed by Biddle et al. (2008, 2016) to categorize the content of each of the websites identified, using their 12 analytical categories (see Table 2).

Because our study was exploratory, using a medium not previously studied in the context of suicide prevention, we examined only the content of the pages of the URLs and did not follow hyperlinks to other content.

The research was conducted between January 2017 and February 2017. Coding of the characteristics of the sites was conducted simultaneously by two research assistants in a university room with secure computers using the TOR software. Technical assistance was always available, as well as supervision from the researchers on methodological issues. In the event that the research assistants were disturbed by content they came across (for example, a “manual of pedophilia”), external confidential clinical support was available to them.

First, each of the two coders independently classified all of the sites identified by the search engines. When the classification was completed, they compared their results. If there was a disagreement, a third coder, (CM or LPC) independently coded the site in question without knowledge of how each of the coders had classified the site. Using the method of Biddle et al. (2016), the categories coded by the three coders were then compared and discussed until a consensus was obtained.

3. Results

We identified a hit as being whenever a research result identified a site. Overall, we consulted and analyzed 476 hits, of which 235 resulted from a search of the term, “suicide”, and 241 resulted from a search of “suicide methods”. Compared to surface web search engines such as Google, research on the Darknet using TOR did not identify as many pertinent sites. Only 52.9% (252/476) lead to actual websites. Of the

Table 2

Analytic categories used in content analysis.

Code	Description
A	Dedicated suicide sites
A1	Suicide sites encouraging/promoting suicide
A2	Sites that describe methods, but do not encourage
A3	Sites that portray suicide/ self-harm in fashionable terms
B	Other sites / pages containing information about suicide methods
B1	Source of factual information (e.g. Encyclopedia/news article)
B2	Discussed in a ‘joking’ fashion that is suggestive of real methods
B3	Completely ‘joking’ and all /most methods described are not real
C	‘Against suicide’ sites
C1	Explicitly ‘forbids’ or opposes suicide
C2	Does not forbid but discourages suicide
D	Support/prevention sites offering information and access to support
D1	Formal organizations
D2	Individuals
E	Academic /policy site focused on suicide
F	Search term not relevant
G	Newspaper article describing a suicide
G1	General news report about a suicide
G2	News report mentioning role of internet in a suicide
Ha	General (i.e. Not suicide) Interactive ‘live’ sites: (discussion boards/ pages; chatrooms/ forums; blogs)
Ha.1	Discussion where focus is on suicide methods (individuals asking for advice; discussing suicide methods; suggesting methods)
Ha1.1	Mostly pro-suicide
Ha1.2	Mostly against suicide
Ha1.3	Mixed content
Ha.2	Discussion about various general issues relating to suicide where methods is not the focus (e.g. Personal accounts of suicidal feelings, coping, self-help, finding help, attempting suicide, causes of suicide)
Ha2.1	Mostly pro-suicide
Ha2.2	Mostly against suicide
Ha2.3	Mixed content
Hb	Suicide specific Interactive ‘live’ sites: (discussion boards/ pages; chatrooms/ forums; blogs)
Hb.1	Discussion where focus is on suicide methods (individuals asking for advice; discussing suicide methods; suggesting methods)
Hb1.1	Mostly pro-suicide
Hb1.2	Mostly against suicide
Hb1.3	Mixed content
Hb.2	Discussion about various general issues relating to suicide where methods is not the focus (e.g. personal accounts of suicidal feelings, coping, self-help, finding help, attempting suicide, causes of suicide)
Hb2.1	Mostly pro-suicide
Hb2.2	Mostly against suicide
Hb2.3	Mixed content
I	Misc. sites reporting on or covering topical issues relating to suicide
J	Page not available
K	Collections of images (e.g. from Google/ Yahoo /Bing /Ask)

others, 31.3% (149/476) did not have content pertinent to the search terms and 21.6% (103/476) were not accessible for various technical reasons, which are discussed in detail in the discussion section.

Table 3 summarizes the results of our categorization of the content of the TOR sites on the Darknet, compared to the Surface Web gateway and the embedded privacy-respecting search engines and dark market. Overall, only 19 of the 476 sites (4%) were dedicated solely to suicide. All these sites described suicide methods but did not encourage them to be used. Most of these 19 websites could be classified as chatrooms, blogs, image boards and anonymous discussion forums. There were another 25 hits out of 476 (4.3%) that contained information about suicide without being identified as being a site with suicide content. One specific site accounted for 11.9% ($N = 56$) of all hits. Because of our desire not to promote use of any specific site, we have not noted the name of this forum in this article. For further information, please contact the corresponding author.

There were very few “anti-suicide” sites (only three of 476, 0.6%), one of which was opposed to suicide and the other two discouraged suicide. There were also very few sites associated with organizations that promote suicide prevention activities, with only 10 of the 476

Table 3
Results by search engine.

	TOTAL	TOR exclusive search engines (n = 5, Torch, Notevil, Ahmia, Candle, Hidden Wiki)	Surface Web Gateway to TOR search results (n = 1, Onion.link)	Embedded privacy respecting search engine (n = 1, Duckduckgo)	Dark Market (n = 1, Grams)
	N (%) of hits	N (%) of hits	N (%) of hits	N (%) of hits	N (%) of hits
Dedicated suicide sites:	19 (4)	8 (2.7)	0 (0)	6 (10)	5 (8.3)
Pro-suicide; encourage, promote, or facilitate	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Describe methods but do not encourage	19 (4)	8 (2.7)	0 (0)	6 (10)	5 (8.3)
Portray suicide in fashionable terms	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
All information sites:	25 (5.3)	5 (1.7)	0 (0)	20 (33.3)	0 (0)
Factual information about suicide methods	10 (2.1)	3 (1)	0 (0)	7 (11.7)	0 (0)
Partly joking/tongue in cheek information but suggestive of real methods	2 (0.4)	0 (0)	0 (0)	2 (3.3)	0 (0)
Source of factual information about suicide (general issues relating to suicide)	13 (2.7)	2 (0.7)	0 (0)	11 (18.3)	0 (0)
Completely joking information: most or all methods described not real	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Against suicide sites	3 (0.6)	0 (0)	0 (0)	3 (5)	0 (0)
Explicitly forbids or opposes suicide	1 (0.2)	0 (0)	0 (0)	1 (1.7)	0 (0)
Does not forbid but discourages suicide	2 (0.4)	0 (0)	0 (0)	2 (3.3)	0 (0)
Prevention or support site	13 (2.7)	0 (0)	0 (0)	13 (21.7)	0 (0)
Support/prevention sites offering information and access to support - Formal organizations	12 (2.5)	0 (0)	0 (0)	12 (20)	0 (0)
Support/prevention sites offering information and access to support - Individuals	1 (0.2)	0 (0)	0 (0)	1 (1.7)	0 (0)
Academic or policy sites	10 (2.1)	3 (1)	2 (3.3)	5 (8.3)	0 (0)
Hit not relevant to search term	149 (31.3)	81 (27.4)	25 (41.7)	0 (0)	43 (71.7)
News reports of individual suicides	5 (1.1)	4 (1.4)	0 (0)	1 (1.7)	0 (0)
General interactive live sites (discussion boards...)	35 (7.4)	28 (9.5)	6 (10)	1 (1.7)	0 (0)
Chat rooms/blog sites focused on suicide methods - mostly pro-suicide	7 (1.5)	6 (2)	0 (0)	1 (1.7)	0 (0)
Chat rooms/blog where focus is on suicide methods - Mixed content	2 (0.4)	2 (0.7)	0 (0)	0 (0)	0 (0)
Chat rooms/blog sites discussing various general issues relating to suicide - mostly pro suicide	1 (0.2)	0 (0)	1 (1.7)	0 (0)	0 (0)
Chat rooms/blog sites discussing various general issues relating to suicide - mostly against suicide	6 (1.3)	5 (1.7)	1 (1.7)	0 (0)	0 (0)
Chat rooms/blog sites discussing various general issues relating to suicide - Mixed content	19 (4)	15 (5.1)	4 (6.7)	0 (0)	0 (0)
Suicide specific Interactive 'live' sites	35 (7.4)	21 (7.1)	14 (23.3)	0 (0)	0 (0)
Suicide specific Interactive sites - Discussion where focus is on suicide methods - Mostly pro-suicide	23 (4.8)	14 (4.7)	9 (15)	0 (0)	0 (0)
Suicide specific Interactive sites - General issues relating to suicide - Mostly pro-suicide	11 (2.3)	6 (2)	5 (8.3)	0 (0)	0 (0)
Suicide specific Interactive sites - General issues relating to suicide - Mixed content	1 (0.2)	1 (0.3)	0 (0)	0 (0)	0 (0)
Miscellaneous sites reporting on topical issues relating to suicide	79 (16.6)	61 (20.6)	3 (5)	7 (11.7)	8 (13.3)
Page not available	103 (21.6)	85 (28.7)	10 (16.7)	4 (6.7)	4 (6.7)
TOTAL	476 (100)	296 (100)	60 (100)	60 (100)	60 (100)

Table 4
Percentage of hits by search engine.

	Keywords		Total
	“Suicide”	“Suicide methods”	
TOR SPECIFIC (n = 5)	N (%)	N (%)	296 (62.18%)
Ahmia	5 (2.13)	12 (4.98)	17
Candle	20 (8.51)	19 (7.88)	39
Torch	30 (12.45)	30 (12.45)	60
Hidden Wiki	30 (12.45)	30 (12.45)	60
TORCH: Tor Search Engine	30 (12.45)	30 (12.45)	60
Notevil	30 (12.45)	30 (12.45)	60
GATEWAY (n = 1)			60 (12.61%)
Onion.link	30 (12.45)	30 (12.45)	60
PRIVACY (n = 1)			60 (12.61%)
Duckduckgo	30 (12.45)	30 (12.45)	60
DARKMARKET (n = 1)			60 (12.61%)
Grams	30 (12.7659574468085)	30 (12.45)	60
Total	235 (100)	241 (100)	476

(2.1%). There was also one individual who had a site that offered support or help for people who are suicidal.

Only 10 of the sites (2.1%) provided general information about suicide, often factual information about suicide methods presented in a fairly neutral manner without promoting use of those methods. There were 12 sites (2.7%) that described suicide in an informative or documentary manner, and there were two sites that treated suicide humorously. A larger number (79, 16.6%) mentioned suicide as a non-central, peripheral topic in the context of other subjects. There were also five sites (1.1%) that had news articles concerning suicide. As seen in Table 4, the type of search engine differed in the percentage of hits, with TOR-specific search engines generating 296 hits (62.2%) and the others generating 60 hits each (12.6%).

The TOR-specific search engines (TORCH, TORCH: the TOR search engine, Notevil, Ahmia, Candle, Hidden Wiki) had the most hits (276, 62.2% of the total), but 28.7% were not accessible and 27.4% were not related to suicide and an additional 20.6% contained limited peripheral anecdotal information about suicide only. Only 2.7% of the hits involved suicide-specific sites. Nevertheless, 7.1% of all the results were interactive sites such as chat boards, but these interactive sites did not contain information on suicide prevention.

Research using “Gateway” with the search engine Onion.link also found that a large percentage (27.4%, 18/60) was not pertinent and unrelated to suicide and 16.7% (10/60) were not accessible. Overall, 14 (23.3%) were suicide-specific chat boards, of which nine (15%) described suicide methods and were categorized as being pro-suicide.

None of these sites had information or links to content on suicide prevention.

In the privacy category, using the search engine Duckduckgo, one-third (33.3%, 20/60) had some factual information about suicide, of which seven (11.7%) provided information on suicide methods and another 11 (18.3%) had general information about suicide. However, 13 sites (21.7%) had some information on suicide prevention or provided some support. These were generally institutional sites (n = 12, 20%), of which five were from academic institutions.

In the “darkmarket” category - using the search engine Grams - most of the sites (71.7%, 43/60) were not pertinent or had almost no content related to suicide. Five (8.3%) encouraged suicide and four (6.7%) of the sites were not accessible.

4. Discussion

Our objective was to describe the nature and the accessibility of

suicide content available through the TOR Darknet search engines, and compare it to results obtained on the generally accessible surface internet, using methodology comparable to Biddle et al. (2016), to the extent possible. Overall, search engines to explore the TOR Darknet are not very effective in finding information about suicide. Not a single one of the TOR-specific, gateway or dark market search engines provided access to sites that are concerned specifically with suicide prevention. The only exception was the search engine Duckduckgo which accessed content on suicide prevention from some academic and institutional sources. The most likely explanation is simply that Duckduckgo is the only one of the eight search engines that also searches sites that are located on the Surface Web.

The potential harmful impact of the Internet is a major ongoing debate in suicidology and the general public. However, this study seems to show that the TOR Darknet might not contain as much dangerous content as some might fear. Nonetheless, it can be assumed that Darknet pro-suicide content would be less scrutinized and censored than an equivalent page on the surface web (cf. Table 1). Hence, suicide prevention experts should remain vigilant and aware of their Darknet pro-suicide content, particularly since the TOR Darknet does not appear to provide much of suicide prevention material or support. Also, the suicide-related content found by this study was mostly pro-suicide. Furthermore, we did not find any TOR-specific prevention material. The only prevention websites were surface web pages accessed through Duckduckgo via the TOR, a search engine that also accesses the surface web.

Our second general observation is that one particular site appeared most often when TOR search engines were used. This site is hosted on the Surface Web, but also has a TOR cloned hidden service in which users can access the site over the Darknet.

In our study, 52.9% of our results were determined to be non-pertinent, inaccessible or not correctly indexed. It is possibly that the difference between Darknet searches and searches on the Surface Web may be due to the fact that Google, Yahoo and similar Surface Web search engines have used vast resources to improve themselves, compared to the TOR-related search engines, which do not have as much financial backing. Biddle et al. (2016) noted that between 2007 and 2014, there were great improvements on the ability of the Surface Web search engines to effectively identify relevant hits. They found that in 2007, 18% (88 hits) were not pertinent to the search terms, but in 2014, this decreased to 3.1% (15 hits).

Finally, as a general observation, it should be noted that this study does not pretend to have explored all the suicide-related content available via the TOR Darknet. First, because the nature of the TOR Darknet is to allow sites to be mainly host private and to house hidden content. Second, TOR search engines seem to be rudimentary and exploratory. The currently available TOR search engine should not be considered as providing an exhaustive means of exploring TOR-related content.

5. Limitations

One of the potential limitations of our results is in the potential difficulty in replicating our study. We used several search engines on TOR that attempt to index sites whose content is often not constructed in such a way that it can be easily indexed. Often, sites accessible using TOR are technically unstable and a significant percentage of pages appeared as inaccessible, sometimes temporarily because of server errors (error 404). TOR search engines face many challenges in the classification of sites and their identification. Some, particularly Grams, were not constructed in a way that the categories developed by Biddle could be identified. Another pertinent example of content instability is the events in February 2017, when one-fifth of TOR was pirated or shut down by Anonymous (Brandom, 2017).

6. Conclusions

Overall, our comparison of search results on the TOR Darknet with the results from Biddle et al. (2016) on the Surface Web indicates that there is much less indexed suicide content identified by the TOR related search engines. However, the nature of the content we identified indicates that the TOR Darknet suicide related content is largely pro-suicide. Unlike the surface web, where a large number of sites providing information and help are easily identified, search engines using TOR find proportionately much less suicide prevention content on the TOR Darknet. These search engines are not as technically sophisticated as the heavily funded search engines used on the Surface Web (such as Bing, Yahoo, Google), so they result in over half the hits being non-pertinent or inaccessible. Nevertheless, TOR provides access to a few very active sites, with large volumes of exchanges that merit to be better understood. It would be useful to better identify users of suicide content on the TOR Darknet and characteristics of participants in forum and message boards, their patterns of use, as well as the nature of their exchanges, and the type of help to prevent suicide or encouragement to proceed with suicide that they obtain. It would also be of use to better understand the motivations associated with using the TOR Darknet sites rather than sites on the Surface Web.

Ethical considerations

Because our research only involved gathering information that is available to the public, according to Canadian laws and ethical standards, no specific approval from an ethics committee is necessary (http://www.ger.ethique.gc.ca/fra/policypolitique/initiatives/tcps2-eptc2/chapter2-chapitre2/#ch2_fr_a2.2).

Author statement

All the authors have approved, reviewed the final article and agreed to let the first author (Carl-Maria Mörch) submit the article.

Carl-Maria Mörch, M.Psy., Ph.D. (cand.): lead researcher, study design, analysis and writing.

Louis-Philippe Côté, Ph.D. (cand.): co-researcher, study design, analysis and writing.

Laurent Corthésy-Blondin, Ph.D. (cand.): data collection, codification and writing.

Léa Plourde-Léveillé, Ph.D. (cand.): data collection, codification and writing.

Luc Dargis: methodology consulting, article preparation, literature review.

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Conflict of interest

The authors declare that they have no conflict of interest.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jad.2018.08.028.

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